1402-XXXXX-001

1402-XXXXX-002

OP-SV

1402-XXXXX-001/002

BARBER COLMAN

2010
IN 9-3

Models 1402-XXXXX-001 and 1402-XXXXX-002 Flameotrols®

The Model 1402-XXXXX-002 is designed to meet FIA requirements.

INSTRUCTION MANUAL

UL®

FM

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THE INSTRUCTIONS GIVEN HEREIN COVER THE DESCRIPTION, INSTALLATION, OPERATION AND MAINTENANCE OF SUBJECT EQUIPMENT. BARBER-COLMAN RESERVES THE RIGHT TO MAKE ENGINEERING REFINEMENTS THAT MAY NOT BE REFLECTED IN THIS BULLETIN.

1. INTRODUCTION

1.1 General Description

The 1402-XXXXX-001 Series Flameotrol is a conductivity-rectification combustion safeguard for either manually or automatically starting up a burner. The 1402-XXXXX-002 will automatically start up a burner.

Input to the Model 1402-1 for gas fired burners is from a 1250 Series Flame Rod. An alternating voltage placed between the grounded flame and the flame Rod is rectified by the flame itself. The resulting direct current is the input to the Flameotrol.

Input to the Model 1402-2 for gas or oil fired burners is from the Model 1292-2 or -3 Ultraviolet Flame-Eye. Bursts of ultraviolet from the flame strike the UV detector tube in the Flame-Eye causing conduction between the two elements in the tube. The resulting output of the tube is a series of high frequency pulses that form the input to the Flameotrol. The Flame-Eye detects only the ultraviolet in the flame and is not affected by infrared radiation from hot furnace linings.

A flame ignition attempt is limited to 15 seconds for either manual or automatic operation. If the pilot flame does not light, lock-out occurs and a manual reset is necessary to start a new cycle. A feature in the circuit provides that even after pressing the front panel Reset pushbutton, ignition will not occur if the pilot flame is already lit or there is a defective electrical component. A d-c voltmeter can be plugged into test jacks to measure the strength of the pilot flame signal. Should pilot flame failure occur, the oven or furnace will shutdown within 4 seconds. Flame fluctuation will not cause system shutdown.

The chassis is plug-in and all wiring to its base can be permanent. The Flameotrol is designed to reject line noise such as that from SCR's. The 1402 Series Flameotrol meets all the requirements of Underwriters' Laboratories, Inc., Standard Code 795 for commercial and industrial gas heating equipment with inputs of 400,000 to 2,500,000 BTUH with manual draft or up to 5,000,000 BTUH with atmospheric burners.

1.2 Specifications

Prepurge Period – 30 seconds standard; 7, 60 or 90 second models available. 7 second models are not UL approved.

Trial for Ignition Period – Fixed. 15 seconds.

Flame Failure Response Time – 1½ to 4 seconds.

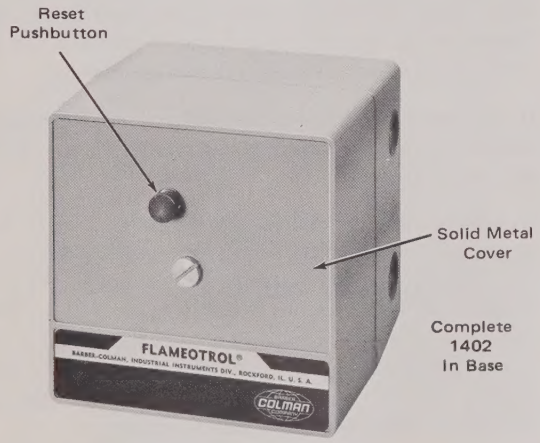
Waiting Time Before Manual Reset – Within 90 seconds.

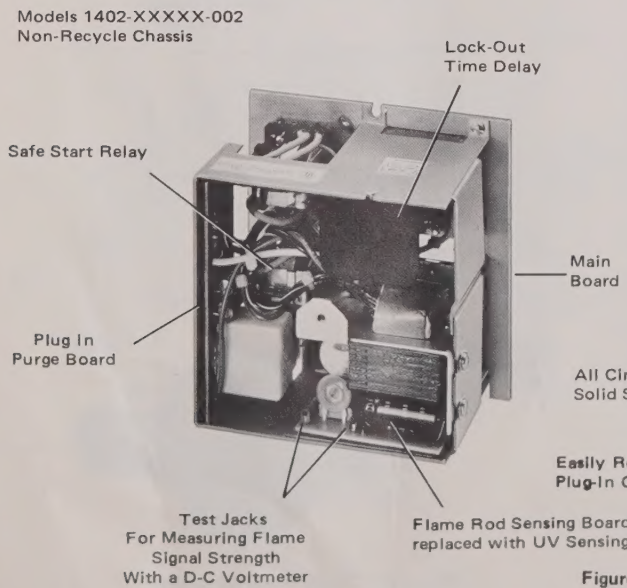
Ambient Temperature – Operating: 32°F to +130°F.

Power Consumption – Either 17 VA (Recycle) or 20 VA (Non-Recycle) at 120 Vac, 50 or 60 Hz.

Mounting – In any position on wall, front of panel, or back of panel.

Connections – Six conduit knockout holes for 1/2-inch conduit allow access to internal terminal strip.





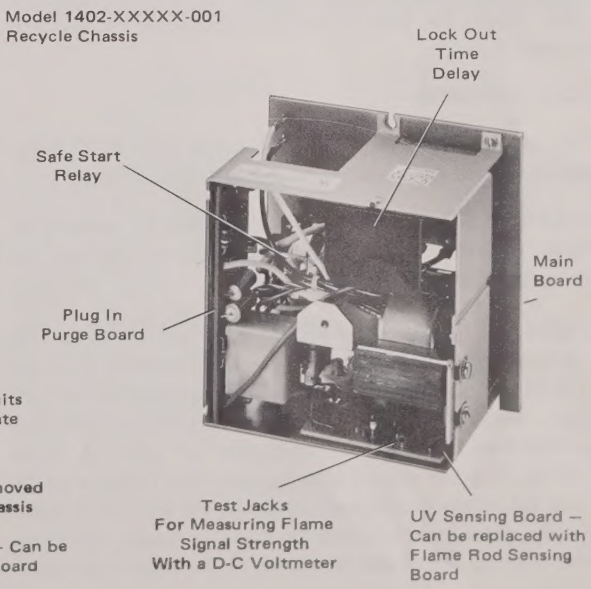


Figure 1-1.

FLAMEOTROL MODEL CODE

1402–X XX XX –00 X

Basic Model Number

Detector
- 1 = Flame Rod
- 2 = Model 1292 Flame-Eye

Purge Timing
- 07 = 7 seconds * ***
- 30 = 30 seconds, standard * **
- 60 = 60 seconds * **
- 90 = 90 seconds * **

Ignition Timing
- 15 = 15 seconds

Cycle
- 1 = None (Recycle Model)
- 2 = Non-Recycle

* FM Approved
** UL Listed
*** Recognized under the Component Program of Underwriters' Laboratories, Inc.

2. INSTALLATION

2.1 After Unpacking

This instrument has been manufactured carefully, inspected, and packed at the Factory. Check the contents of the shipping container against the packing slip. If the equipment is damaged in transit, report the extent of the damage to the carrier immediately. Repack in the original box until ready for installation. Any instructions given on tags attached to the instrument should be followed and then the tags should be removed. Handle with care.

2.2 Mounting

2.2.1 General

The Flameotrol sensor, either Flame-Eye or Flame Rod, should be installed according to the burner manufacturer's recommendations. If such recommendations are not available, follow the instructions in either paragraph 2.2.3 or paragraph 2.2.4.

2.2.2 Flameotrol

The ambient temperature must be within 0° to +130°F. Avoid furnace walls and other sources of radiant heat.

See Figure 2-1. The Flameotrol is designed for either wall, front of panel, or internal panel mounting. It can be mounted in any position.

Figure 2-1 shows the base, chassis and cover of the Flameotrol. First mount the base. Six knockout holes for 1/2-inch conduit provide access to the terminal strip in the base. Next connect the external wiring to the terminal strip in the base according to paragraphs 2.3 and 2.4. After wiring, plug the chassis into the base, and fasten it to the base by means of the two screws at the top and bottom. Lastly, place the cover onto the base and chassis, and fasten the cover to the chassis by means of the single front panel screw.

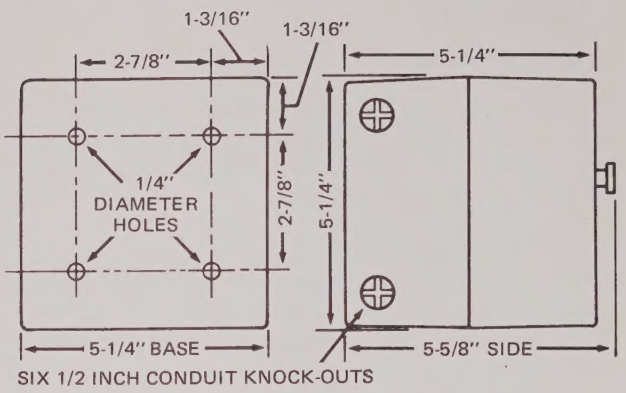


Figure 2-1. Mounting Dimensions

2.2.3 Flame-Eye

The dimensions of the Flame-Eye are 3-5/8 inches long and 1-5/8 inches diameter. Mount the Flame-Eye by means of the 3/4-inch internal NPT on the Adapter. The Flame-Eye is held to the Adapter by a knurled thumb screw.

Many burners provide an opening for sensor mounting. If such an opening is available, locate the Flame-Eye within 18 inches of the Flame for optimum results. The target area must be filled with flame at all times to provide a reliable flame signal. To insure ignition of the main flame, set the Flame-Eye so that the pilot flame is visible at the point where the ignition of the main flame should occur.

If an opening for sensor mounting is not available and directions from the burner manufacturer are not available, proceed as follows.

A sighting tube is required and should be a 6- or 8-inch length of 3/4-NPT black iron pipe threaded on one end. The threads are for fastening either Adapter 11-3481, Adapter 11-3489, Nipple 6-103 (Figure 2-2) or Flange Assembly A-6792 (Figure 2-3) to the sighting tube. Galvanized and stainless steel pipe are not suitable for a sighting tube since these materials reflect light and cause difficulty in determining the tube alignment.

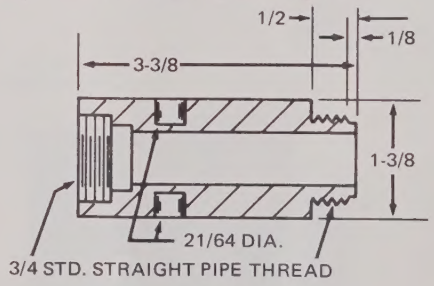


Figure 2-2. Nipple 6-103

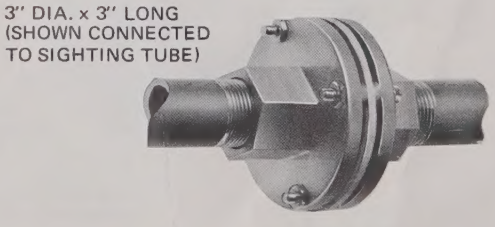


Figure 2-3. Flange Assembly A-6792

First determine the approximate sighting tube angle. See Figure 2-4. Cut a hole through the wall of the burner. Tack weld the sighting tube for an alignment check. After the correct setting is determined and the minimum pilot test is made (paragraph 2.6.1) weld the sighting tube permanently into position.

After the sighting tube is installed, screw the Adapter onto the threaded end of the tube. If ambient temperatures are high, or heat conditions along the sighting tube raise the temperature of the Flame-Eye above 212°F a heat insulating Nipple, part number 6-103, can be mounted between the sighting tube and the Adapter. There is a hole blocked by a thin wall of plastic in the Nipple which can be opened so that a small amount of air can be drawn into the sighting tube to keep the Flame-Eye cool and clear of smoke. The hole can be threaded for 1/8-inch NPT so that air can be forced into the sighting tube. The Nipple is not suitable above 300°F. Instead above 300°F, Flange Assembly A-6792 must be fastened to the sighting tube.

2.2.4 Flame Rod

A Flame Rod is suitable only for gas fired burners. Its location in the gas flame is critical since it conducts and rectifies only a small electrical current. Figure 2-6 shows the dimensions of typical Flame Rods.

Proceed as follows to install the Flame Rod:

1. Position the Flame Rod to contact a pilot flame large enough to reliably light the main burner (Figure 2-5).

2. Extend the Flame Rod into the convergence of the pilot flame and the main flame.

3. If possible, point the Flame Rod horizontal or downward to prevent dirt accumulation between the Flame Rod and ground.

4. The length of the Flame Rod should be enough for the electrode head of the Flame Rod to operate under 150°F. Avoid excess Flame Rod in the flame being monitored. If the Flame Rod is red hot for more than 2 inches, a shorter rod is recommended unless the length is needed to maintain a ground to rod area ratio of 1-1/2 to 1. Ground to rod area ratio is the ratio of the area in contact with the flame on the burner to the area in contact with the flame on the Flame Rod.

5. Clearance around the Flame Rod must be at least 1/2-inch, which should be enough to avoid grounding the Flame Rod against brickwork or against the burner.

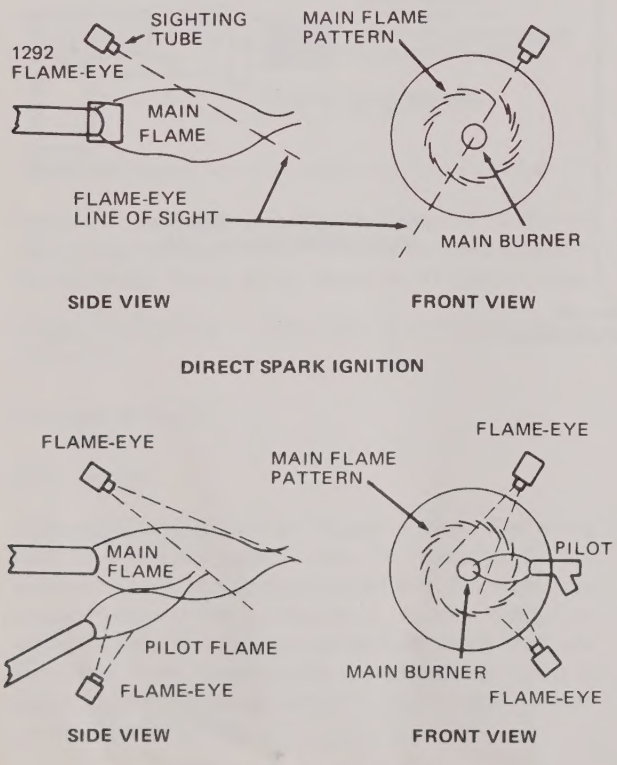


Figure 2-4.
Sighting Tube Alignment

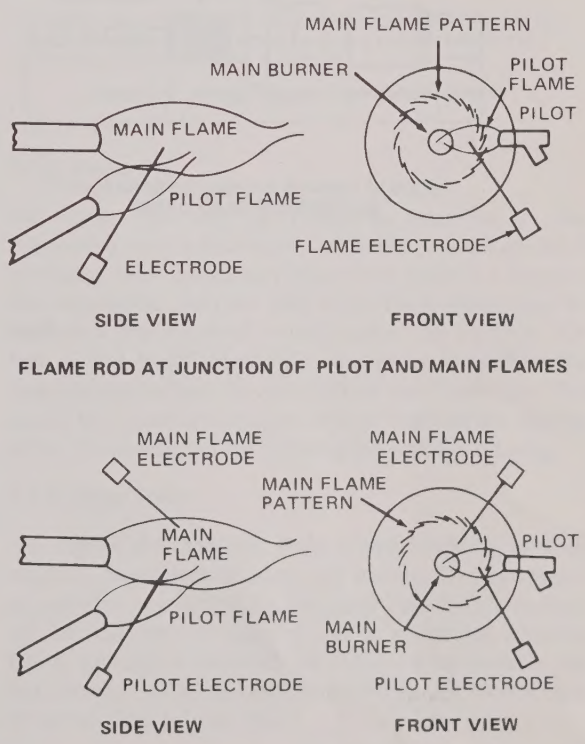
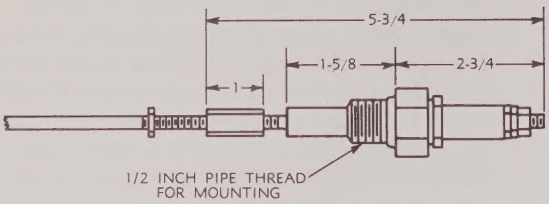
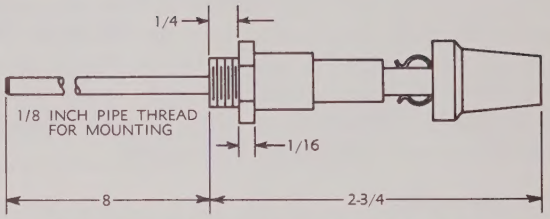


Figure 2-5.
Flame Rod Location

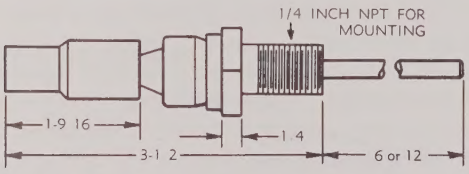


MODEL 1256-2 ELECTRODE HEAD

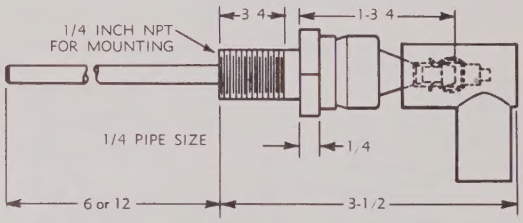


MODEL 1256-8-1 ELECTRODE HEAD & ROD

MODEL 1256-8-2 HAS HIGH TEMPERATURE FLAME ROD

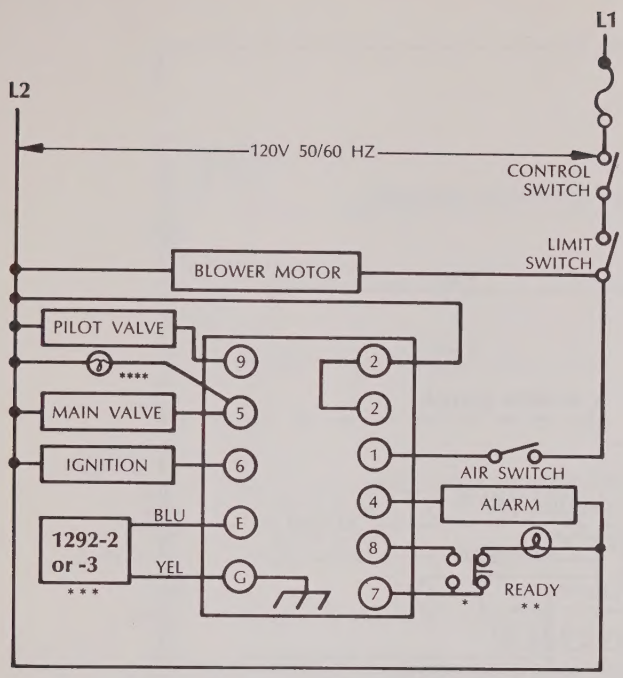


MODELS 1256-4-6 & 1256-4-12 STRAIGHT
ELECTRODE HEAD & ROD



MODELS 1256-14-6 & 1256-14-12
ELECTRODE HEAD & ROD

Figure 2-6
Flame Rod Dimensions



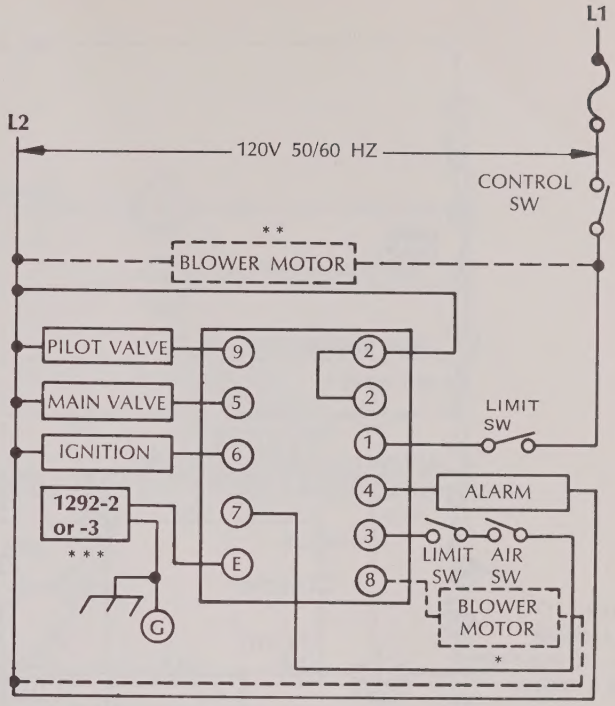
*USE MOMENTARY CONTACT TYPE PUSHBUTTON FOR MANUAL START. JUMPER 7 TO 8 FOR AUTOMATIC START.

**READY LIGHT USED ON MANUAL START ONLY.

***1292-2 OR -3 USED ON 1402-2. CONNECT ROD TO E FOR USE ON 1402-1, & ELECTRICALLY GROUND G TO CONDUIT OR TO MAIN BURNER.

****OPTIONAL FOR FLAME ON INDICATION.

Figure 2-7. Wiring Diagram, Recycle Models



*BLOWER MOTOR DE-ENERGIZED ON FLAME FAILURE WHEN CONNECTED TO TERMINAL 8.

**BLOWER MOTOR IS DE-ENERGIZED ONLY UPON OPENING OF CONTROL SWITCH.

***1292-2 OR -3 USED ON 1402-2. CONNECT ROD TO E FOR USE ON 1402-1, AND ELECTRICALLY GROUND G TO CONDUIT OR TO MAIN BURNER.

Figure 2-8. Wiring Diagram, Non-Recycle Models

2.3 Power Wiring

Input line voltage must be 120 Vac, 50 or 60 Hz. Do not place power wiring and sensor wiring in the same conduit or wiring trough. Power wiring should be 14 gage or larger.

Recycle Models Only: — fuse with 8A, 3AB Little fuse, or equivalent.

2.4 Input Wiring

2.4.1 General

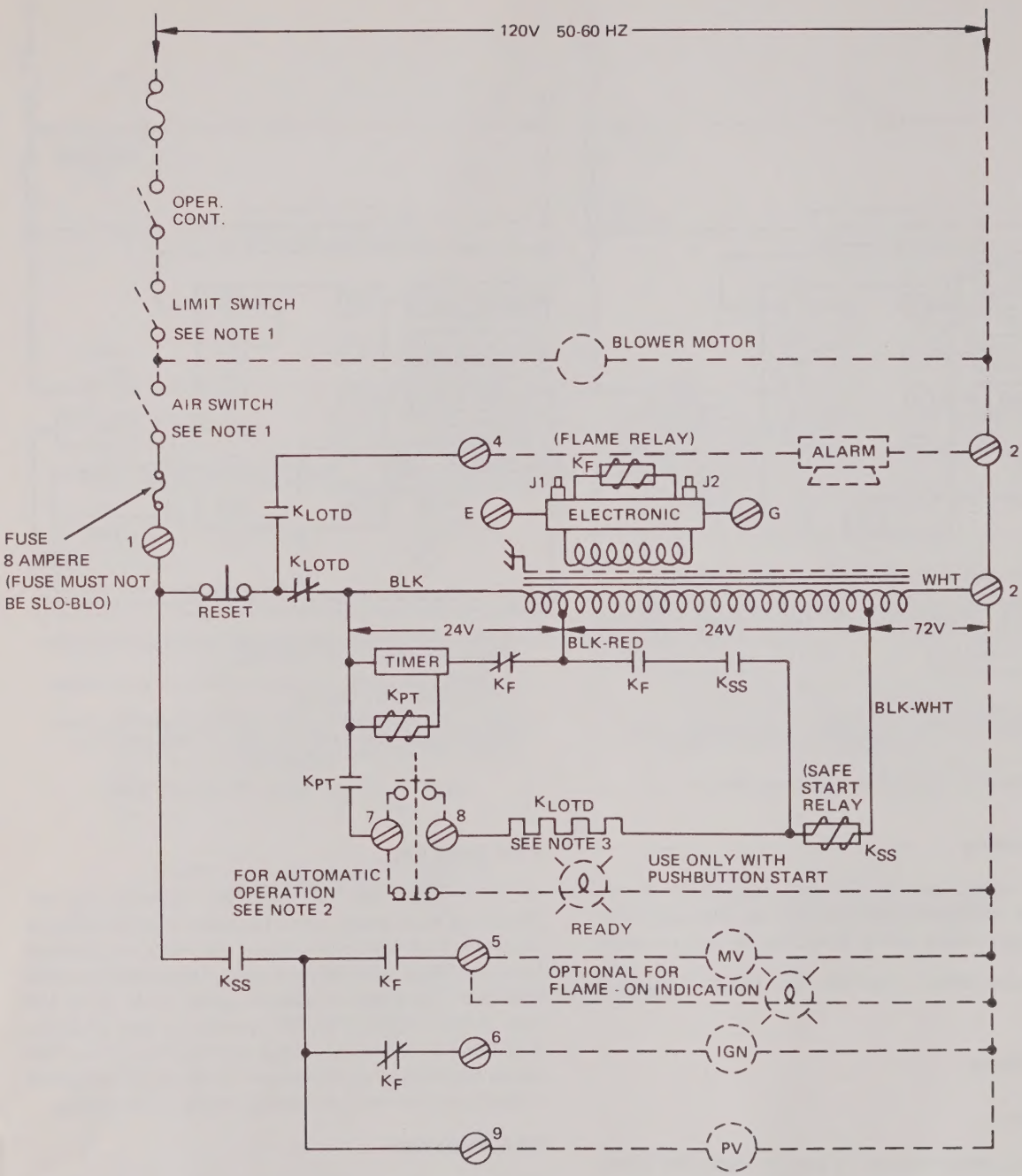
Flame signal wiring must be 18 gage or larger. The wiring must have moisture resistant type TW insulation. Do not wire with cotton or asbestos insulated wire. The wires from several flame rod inputs may be in the same conduit or wiring trough. Do not put inputs from more than one Flame-Eye in the same conduit or wiring trough unless in shielded cable. All sensor leadwires must be separate from power and other wiring.

2.4.2 Flame-Eye

See Figures 2-7 and 2-8. Flame-Eye leadwires are two 7-foot-long color coded wires. Leadwires may be spliced if necessary. Such splices may have to be made in a junction box, depending upon the local code. These splices must be accessible. The length of leadwire added can be up to 100 feet. A free length of flexible conduit, at least 18 inches long, should enclose the wiring from the Flame-Eye. This allows the Detector to be removed for checking the sighting of the Flame-Eye and for exposing the tube for cleaning.

2.4.3 Flame Rod

See Figures 2-7 and 2-8. Make a good bonding between conduit, Flameotrol housing, and burner. This bonding is an electrical connection for the signal from the Flame Rod. Up to 100 feet of leadwire can be connected between Flame Rod and Flameotrol. Do not splice the leadwire. Do not connect to the terminal marked S on the Model 1256 or Model 1256-1 Flame Rod.



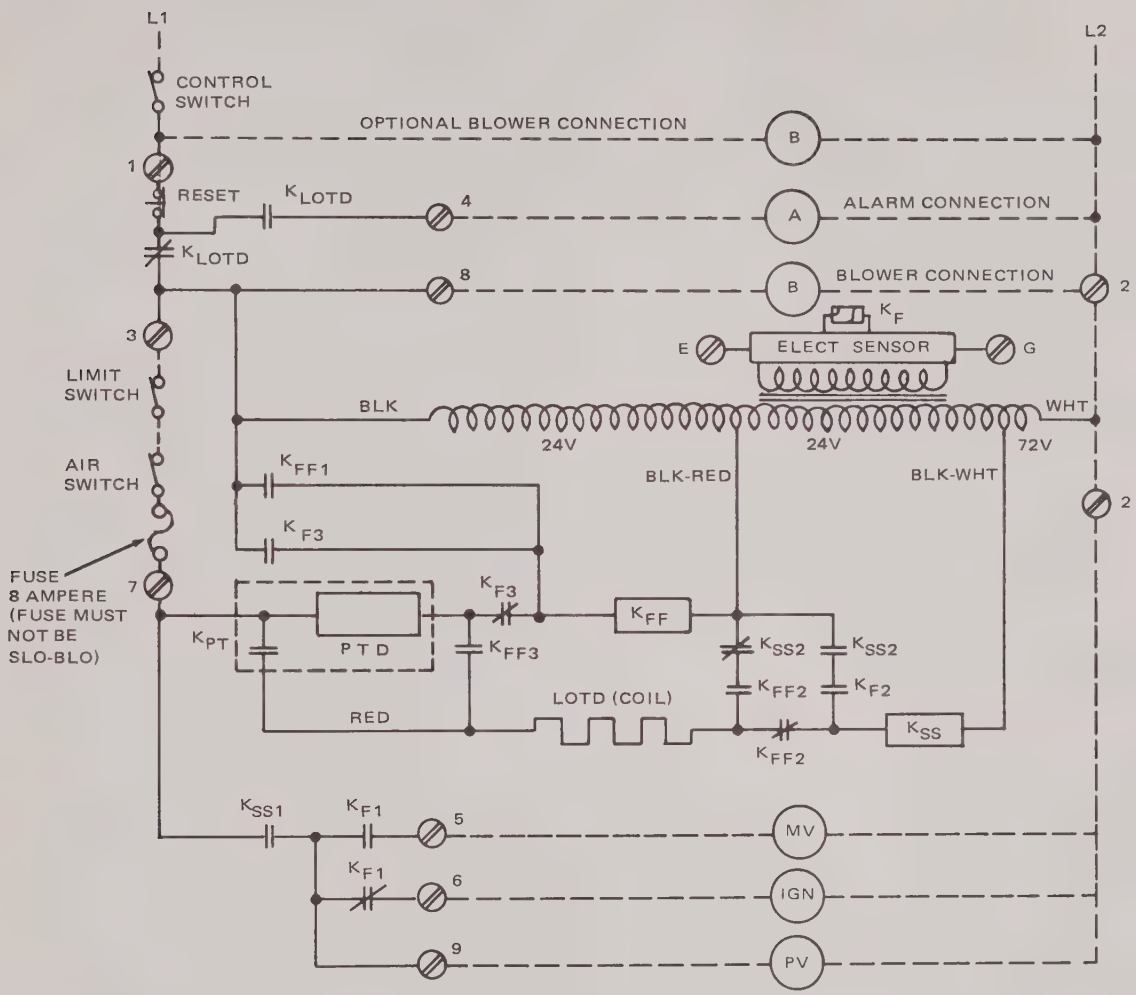
COMPONENT SYMBOLS:

K_F – FLAME RELAY
K_{SS} – SAFE START RELAY
K_{PT} – PURGE TIMER RELAY
K_{LOTD} – LOCK-OUT TIME DELAY RELAY
SOLID LINES – INTERNAL WIRING
BROKEN LINES – EXTERNAL WIRING

NOTES:

1. IF LIMIT AND AIR SWITCHES ARE NOT USED, WIRE OPERATING CONTROL DIRECTLY TO TERMINAL NUMBER 1.
2. USE MOMENTARY 2-CIRCUIT PUSHBUTTON SWITCH (1 CIRCUIT ON, 1 CIRCUIT OFF) FOR MANUAL OPERATION. JUMPER 7 TO 8 FOR AUTOMATIC OPERATION.

Figure 2-9. 1402 Series Crossline Wiring Diagram for Recycle Models



K_F — FLAME RELAY
K_{FF} — FLAME FAILURE RELAY
K_{SS} — SAFE START RELAY
K_{PT} — PURGE TIMER RELAY
K_{LOTD} — LOCK-OUT TIME DELAY RELAY
SOLID LINES — INTERNAL WIRING
BROKEN LINES — EXTERNAL WIRING

NOTE

If limit and air switches are not used, jumper directly from terminal number 3 to number 7.

Figure 2-10. 1402 Series Crossline Wiring Diagram for Non-Recycle Models

2.5 Output Wiring

Figures 2-9 and 2-10 show typical external wiring and also the internal wiring except for the electronic circuit.

Relay Contacts (Recycle Models):

Terminal	Load	Maximum VA	
4	Alarm	125 VA	Pilot Duty
5	Main Valve	125 VA	Pilot Duty*
6	Ignition Transformer	300 VA	
7	READY signal lamp	50 VA	
9	Pilot Valve	125 VA	Pilot Duty

*or 25 VA pilot duty plus one or more motorized valves with a total rating up to 400 VA opening and 200 VA holding.

Relay Contacts (Non-Recycle Models):

Terminal	Load	Maximum VA	
4	Alarm	125 VA	Pilot Duty
5	Main Valve	125 VA	Pilot Duty*
6	Igniton Transformer	300 VA	
8	Blower Motor	1/2 Horsepower	
9	Pilot Valve	125 VA	Pilot Duty

*or 25 VA pilot duty plus one or more motorized valves with a total rating up to 400 VA opening and 200 VA holding.

2.6 Installation Adjustments

2.6.1 Minimum Pilot Test

Proceed as follows:

1. Turn the Flameotrol power off.
2. Close the manual shutoff valve on the main fuel line, or disconnect the wiring to the main fuel valve in the main fuel line.
3. Turn on power to the Flameotrol. Trial for ignition will start automatically.
4. Reduce the size of the pilot flame by closing the manual valve in the pilot gas line until the Flame Relay in the Flameotrol drops out. See Figure 1-2 for the location of the Flame Relay.
5. If the pilot flame is out, relight it and increase the size of the flame until the flame relay just pulls in. Fifteen seconds is available to perform steps 6 and 7 before lockout occurs.
6. Turn the Flameotrol power off.
7. Do the reverse of step 2.
8. The main flame must light quickly from the pilot flame. If it does not, turn the power off or close the main fuel shutoff valve immediately. The pilot flame is not large enough. Repeat steps 1 through 8 but with a slightly increased opening of the manual valve ... the pilot gas line. A satisfactory flame will cause the following voltage difference between test jack terminals J1 and J2:

   Flame-Eye Sensor: 80 Vdc or more
   Flame Rod Sensor: 1.0 Vdc or more

2.6.2 Space Ignition Test

If the gas pilot is ignited by a spark from an ignition transformer, proceed as follows:

1. Turn off valves to the pilot fuel line and the main fuel line.
2. Turn on power to the Flameotrol.
3. After completion of the purging cycle, press the front panel pushbutton (if in manual operation) to energize the pilot solenoid and the ignition transformer.
4. Pilot flame will not burn as fuel is turned off.
5. Flame Relay should not pull in as no flame is present. Figure 1-2 shows location of Flame Relay. If the flame relay does pull in, the Flame-Eye must be realigned to prevent a spark or a spark reflection being detected.
6. Pilot solenoid and ignition transformer will deenergize in 15 seconds and the main fuel valve will remain closed.
7. Terminal 4 will be powered and alarm will sound.
8. Press reset pushbutton to silence alarm and start new operating cycle.

3. OPERATION

3.1 Manual — Recycle Models Only

Proceed as follows:

1. Connect a momentary 2-circuit pushbutton switch (1 circuit ON, 1 circuit OFF) between terminals 7 and 8.
2. Connect a ready signal lamp between terminals 2 and through the momentary 2-circuit pushbutton switch to terminal 7.
3. Turn on power and close the control switch to the Flameotrol to start a purge period of either 7, 30, 60, or 90 seconds — see rating label.
4. At the end of the purge period the signal lamp lights, indicating that the main burner is ready for lighting.
5. Depress the start pushbutton and hold it down to supply power to the pilot valve and the ignition transformer terminals.
6. Release the start pushbutton after the pilot flame burns.
7. When the pilot flame is detected by the sensor, the main valve terminal is supplied with power, causing the main burner valve to be energized, and the ignition transformer to be deenergized.

8. If the pilot flame is not ignited in 15 seconds, the Main Valve will not be energized and lockout will occur. The alarm terminal will be energized. Manual reset is required.

9. Should pilot flame failure occur at any time during burner firing, system shutdown will occur within 4 seconds.

10. After flame failure, a purging period occurs, provided the system is signaling for heat.

11. The start pushbutton can then be pressed for another lighting attempt.

12. If the pilot flame does not ignite within a nominal 15 seconds, the alarm terminal will be energized and the valves deenergized. After a 90-second delay, press the RESET pushbutton to start a new cycle.

3.2 Automatic – All Models

When there is a signal for heat, an automatic main burner start up cycle occurs when either power is supplied to the Flameotrol or an interrupted power source is restored. Proceed as follows:

1. Connect a jumper between terminals 7 and 8. **(Recycle models only).**

2. Provided the system is signaling for heat, close the control switch to the Flameotrol to start a purge period of either 7, 30, 60, or 90 seconds. The rating label shows the purge period for the model you have.

3. At the end of the purge period, power is supplied to pilot valve and ignition transformer terminals, causing the pilot flame to ignite.

4. When the pilot flame is detected by the sensor, the main valve terminal is supplied with power, causing the main burner valve to be energized, and the ignition transformer to be deenergized.

5. If the pilot flame does not ignite in 15 seconds, the alarm terminal will be energized.

6. Should flame failure occur at any time during burner firing, system shutdown will occur within 4 seconds from flame failure.

7. After main flame failure, a purging period occurs and then one automatic attempt to relight the main flame occurs (recycle model only). Non-recycle model will lockout.

8. If the pilot flame does not ignite within 15 seconds, the alarm terminal will be energized and the valves deenergized. After a 90-second delay, the front panel RESET pushbutton must be pressed before attempting to relight the main flame by pressing the start pushbutton.

4. CIRCUIT DESCRIPTION

Figures 2-9 and 2-10 show the general internal circuit of the Flameotrol only to better illustrate the external connections.

5. SERVICE

5.1 General

When a malfunction is located in the Flameotrol, replace the defective part only if it is called out in Table 5-1.

To replace the Lock-out Time Delay, proceed as follows.

1. The Lock-out Time Delay has been plugged into a board. Two of its pins have been soldered to large "solder pads" on the board.

2. Heat and remove the solder from these two pads with a "solder sucker."

3. Remove the single screw that holds the Lock-out Time Delay in place.

4. Unplug the Lock-out Time Delay.

5.2 Troubleshooting

5.2.1 Flame-Eye and Flameotrol

If the tube in the Detector is inoperative, replace the UV tube. Keep the face of the ultraviolet ray tube in the Detector clean.

See Figure 1-2 for location of test jacks. The red test jack terminal is positive, black terminal is negative.

With a satisfactory flame, a 0–150 Vdc voltmeter of 20,000 ohms per volt sensitivity connected between test jack terminals J1 and J2 should indicate 80 Vdc or more. Large variations in the voltage or unsteadiness of voltmeter reading can indicate an unstable flame condition. If the voltmeter reads less than 80 Vdc, check the following:

1. Alignment and sighting.

2. Dirty tube face on the Flame-Eye.

3. Line voltage below 102 Vac.

4. Weak ultraviolet sensing tube in the Detector.

5.2.2 Flame Rod and Flameotrol

Figure 2-6 shows Flame Rod part numbers. With a satisfactory flame, a 0–10 Vdc voltmeter of 20,000 ohms per volt sensitivity connected between test jacks J1 and J2 should indicate 1.0 Vdc or more. Large variations in the voltage or unsteadiness of voltmeter reading indicates either an unstable flame condition or that the Flame Rod is out of position.

5.3 Service Information

For any service information please call either your local Industrial Instruments Division office or the sales office at Rockford.

Table 5-1. Flameotrol Replaceable Parts

Model Type	Purge Time In Seconds	Model	Plug-In Chassis	Plug-In Sensing Board	Plug-In Purge Board	Main Board	Plug-In Lockout Time Delay	Case Assembly (Consists of Cover Assembly and Base Assembly)	Cover Assembly	Base Assembly (Includes Terminal Block Assembly)	Terminal Block Assembly
Recycle	7	1402-10715-001	A-11027-100	A-10925 (Input: Flame Rod)	A-11026-100	A-11023	A-11035	A-10127	A-10071	A-10070	A-10072
	30	1402-13015-001	A-11027-200		A-11026-200						
	60	1402-16015-001	A-11027-300		A-11026-300						
	90	1402-19015-001	A-11027-400		A-11026-400						
	7	1402-20715-001	A-11027-500	A-11025 (Input: Model 1292-2 or -3 — Ultraviolet)	A-11026-100						
	30	1402-23015-001	A-11027-600		A-11026-200						
	60	1402-26015-001	A-11027-700		A-11026-300						
	90	1402-29015-001	A-11027-800		A-11026-400						
Lockout	7	1402-10715-002	A-11028-100	A-10925 (Input: Flame Rod)	A-11026-100	A-11024	A-11035	A-11161	A-10071	A-11159	A-11160
	30	1402-13015-002	A-11028-200		A-11026-200						
	60	1402-16015-002	A-11028-300		A-11026-300						
	90	1402-19015-002	A-11028-400		A-11026-400						
	7	1402-20715-002	A-11028-500	A-11025 (Input: Model 1292-2 or -3 — Ultraviolet)	A-11026-100						
	30	1402-23015-002	A-11028-600		A-11026-200						
	60	1402-26015-002	A-11028-700		A-11026-300						
	90	1402-29015-002	A-11028-800		A-11026-400						

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